DIVISION OF ENVIRONMENT
QUALITY MANAGEMENT PLAN

PART III:

ENVIRONMENTAL RADIATION SURVEILLANCE PROGRAM
QUALITY ASSURANCE PROGRAM PLAN

Kansas Department of Health and Environment
Division of Environment
Bureau of Air and Radiation
Radiation and Asbestos Control Program
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Section 1

OVERVIEW

1.1 Purpose and Scope

This document is the Quality Assurance Program Plan (QAPP) for the Environmental Radiation Surveillance (ERS) Program, administered by the Environmental Radiation and Emergency Preparedness (EREP) Unit staff, of the Radiation and Asbestos Control Program, Bureau of Air and Radiation (BAR), Division of Environment, Kansas Department of Health and Environment (KDHE). The purpose of the QAPP is to define and document the quality assurance (QA) and quality control (QC) activities of the program and ensure the validity of all data produced in the course of operations. Where applicable, this QAPP references the ERS Standard Operating Procedures (ERS SOP). The provisions of this plan apply to sampling conducted at sites surrounding the Wolf Creek Nuclear Power Plant, and any other monitoring or sampling performed within the scope of the program.

1.2 Developmental History of Plan

This plan covers the sampling conducted in the environment surrounding Wolf Creek Generating Station (WCGS) by the Kansas Department of Health and Environment (KDHE) according to K.A.R. 28-19-81. KDHE's WCGS environmental radiation surveillance program began in 1979 with the initiation of selected surface water locations, and was fully set up by 1984.

In July of 1984 a cooperative agreement was established between KDHE and the United States Nuclear Regulatory Commission (NRC). The cooperative agreement, denoted NRC-31-84-502, established an NRC radiation monitoring network, set criteria for split samples, and designated collocated air sampling stations. The NRC cooperative agreement ended December 31, 1997. The NRC TLD network was dismantled but other program elements remain and are a fundamental part of KDHE's environmental radiation data quality assurance program. This program provides reasonable confidence that the environmental measurements obtained by Wolf Creek Nuclear Operating Corporation (WCNOC), a licensee of the NRC, are accurate and reasonable.

WCGS became fully operational in 1985, allowing for a year of pre-operational data collection for use as a baseline. The purpose of the operational environmental radiation surveillance program, instituted in 1985, is to detect, identify, and measure any radioactive material released to the environment in effluents resulting from the operation WCGS. If elevated levels of radioactivity are detected, this information will then be used to decide whether corrective or protective actions should be taken.

Between September 1999 and March 2000 the program underwent an internal review. This review showed that some improvements in the efficiency and the quality of the science involved were

needed. As a result, in July 2000 a revised program was approved and implemented by KDHE. The changes, which include adding random sampling points and some new sample collection and analysis techniques, are outlined in the paragraphs below. While the primary purpose of the program remains the same, the focus has shifted to include not only the detection of ongoing effluent releases but also to evaluate long term effects of Wolf Creek operations on the environment of Coffey County and Kansas.

Although not its primary function, the operational environmental radiation surveillance program is also essential to the State's *Nuclear Facilities Incident Response Plan*. If an accidental release of radioactive materials from WCGS should occur, data collected from air and radiation monitoring sites will be used to accurately calculate doses to affected populations and to assess any environmental impact.

The WCGS environmental radiation surveillance program includes monitoring of ambient external radiation levels using thermoluminescent dosimetry (TLD), monitoring of concentrations of radionuclides present in ambient air through weekly collection and laboratory analysis of continuous air samples. The program also monitors concentrations of radionuclides and specific isotopes in the environment surrounding the WCGS through the scheduled collection and laboratory analysis of water, milk, terrestrial vegetation, aquatic vegetation, fish, sediment, and soil samples.

1.3 Operational Overview

State personnel will perform or should be present at all routine environmental sampling, sample splitting with WCNOC personnel, and sample preparation and analysis unless otherwise specified or agreed upon. Sample collection at collocated sites is coordinated with WCNOC environmental personnel so that sample results cover the same period. Where split samples are required, every effort will be made to have a KDHE employee present at the time of sample collection. Samples are returned to KDHE facilities after collection. Analyses are done in the DHEL Radiochemistry Laboratory at Forbes Field. State TLDs are processed by the Environmental Radiation and Emergency Preparedness (ER&EP) section of the Radiation and Asbestos Control Program of the Bureau of Air and Radiation.

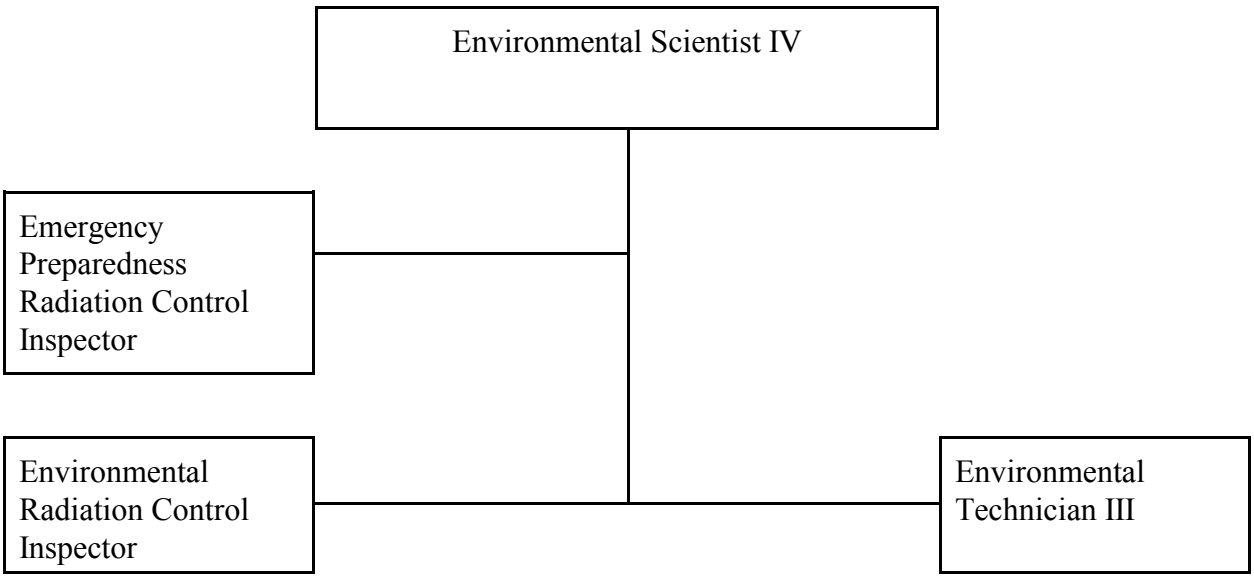
WCNOC has a contract with *Environmental, Inc.* of Northbrook, IL. for laboratory analysis of samples collected in the WCGS environs and split samples. Wolf Creek TLDs are evaluated by Enrico Fermi Nuclear Generating Station, Unit 2.

Section 2

ORGANIZATIONAL DESCRIPTION

2.1 Organizational Chart

Environmental Radiation Surveillance is performed by Environmental Radiation and Emergency Preparedness (EREP) Unit staff. The organizational chart for the EREP Unit of the Radiation and Asbestos Control Program is:



2.2 Responsibilities

The Environmental Scientist IV is responsible for administering the unit's environmental monitoring programs and assuring that QA/QC is implemented as written.

The Environmental Radiation Control Inspector is responsible for the day-to-day operation and activities of the program and coordinates activities with the program's Environmental Technician III. This position occasionally performs sample collection and is responsible for management of the data generated by the program and publication of the required reports.

The Environmental Technician III is responsible for scheduled monitoring and sample collection at WCGS as well as maintenance of the monitoring locations and the associated equipment and instrumentation.

2.3 Distribution

This document, the Environmental Radiation Surveillance Program QAPP and any revisions will be distributed to:

Radiation and Asbestos Control Program, Section Chief
EREP Environmental Scientist IV
EREP Environmental Radiation Control Inspector
EREP Environmental Technician III
Bureau of Air and Radiation (BAR) QA Representative

Section 3

DATA PERFORMANCE CRITERIA

This section provides a description of data performance criteria expressed in terms of data precision, accuracy, completeness, comparability and representativeness for each parameter of interest.

3.1 Precision

Precision is defined as the level of agreement among individual measurements of the same property, conducted under identical or similar conditions.

KDHE data is compared to WCNOC data from all co-located sample collection sites. There are two factors affecting the overall comparability of analysis. The first is the difference in sample analysis time; WCNOC samples are generally analyzed 5 to 15 days later than KDHE samples, and the second is the difference in reporting basis; WCNOC primarily reports most biological media in wet weight and KDHE reports in dry weight.

There will be sample splitting between KDHE and WCNOC personnel.

For both co-located and split samples, the agreement ratio of the KDHE value to the WCNOC value is calculated. A ratio greater than 2.0 or less than 0.5 should be investigated.

3.2 Accuracy

Accuracy is defined as the extent to which a measured value actually represents the condition being measured. Accuracy is influenced by the degree of random error (precision) and systematic error (bias) inherent in the measurement operation (e.g., environmental sampling and analytical operations).

KDHE participates in the Department of Energy's International Intercomparison of Environmental Dosimeters. This program has boasted up to one hundred and twenty one participants from 31 countries. KDHE results have always compared well in this study.

3.3 Completeness

Completeness is defined as a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

KDHE has the goal of collecting 100 percent valid data. Attachment 1, Wolf Creek Environmental Radiation Surveillance Sample Checklist, provides a checklist that can be used to ensure all samples are obtained. Environmental conditions (floods, drought, etc.) and logistical problems may prevent some samples from being collected. Every effort shall be made to collect all samples, but in

situations where a media is simply unavailable, the omission will be documented and included in the annual report.

3.4 Comparability

Comparability is defined as a measure of the confidence with which one item (e.g., data set) can be compared to another.

Comparability is achieved by using generally accepted units. The unit of radioactivity used is the pico-Curie (pCi). One pCi is equal to 2.22 disintegrations per minute or 0.037 Becquerels (Bq). Radioactivity concentrations in liquids such as water and milk are expressed in pico-Curies per liter (pCi/ℓ), radioactivity concentrations in air are expressed in pico- Curies per cubic meter (pCi/m^3), and radioactivity in solids such as soil or vegetation is expressed in pico- Curies per kilogram (pCi/kg). TLD exposure results are expressed as milliRoentgen (mR) per a 90-day quarter. One mR is equivalent to ten micro-Grays (10 μGy or 10^{-5} Gy) *Note: for purposes of this plan, 1R = 1 Rad for photons in air (air kerma).*

Radioactive decay of unstable atomic nuclei is a totally random event. The larger the number of total counts obtained and the longer each sample is counted, the closer the measurements will be to their actual value. Due to the large number of samples to be analyzed and the limited time available for counting individual samples, each sample is counted only once and for the minimum time necessary to reduce the statistical error to an acceptable level. Unless otherwise specified, results for all samples are reported at the 95 percent confidence level. Because estimates of systematic (non-random) uncertainties involved in sample collection and sample preparation are highly subjective and generally difficult or impossible to achieve with any substantial accuracy, the DHEL Radiochemistry Laboratory reports only the uncertainty resulting from random processes (propagation of statistical counting error).

A “less than” value reported shows that the radioactivity in the sample is below the lower limit of detection for the procedures, equipment, and counting time used. Method detection limits (MDLs) depend on the sample matrix, sample size, counting time, detector efficiencies, and type of measurement required. The DHEL Radiochemistry Laboratory MDL’s for various analyses will maintain the 95% confidence level and will be summarized in each year’s report.

3.5 Representativeness

Representativeness is defined as a measure of the degree to which data accurately and precisely represent a selected characteristic of a monitored system.

Except for routine sampling, the location and timing of most biota samples is based upon anticipated harvest or peak growing seasons. Sample locations, media and frequency of collection of all other samples are based upon established NRC guidelines for operational reactor plants, current and historical weather and land use patterns and sufficient control and random samples to validate and challenge the current system.

Section 4

NETWORK DESCRIPTION

The purpose of this section to provide a description of, and rationale for, intended sampling frequency, sampling network design and monitoring site selection criteria.

4.1 Sampling Checklist

Attachment 1 is the Wolf Creek Environmental Radiation Surveillance Sample Checklist. This provides a schedule of where and when to sample.

4.2 Surveillance and Reporting Deadlines

4.2.1 Surveillance and reporting deadlines, sampling and maintenance frequencies, and quality assurance requirements are outlined below. The following grace periods are allowed for maintenance, reporting and sampling requirements:

Frequency	Grace Period
Daily	None
Weekly	± One Day
Monthly	± One Week
Quarterly	± Two Weeks
Semi-Annually	± One Month
Annually	± Three Months
Biennially	± Six Months

4.2.2 January

January 1st, WCNOC proposed radiological environmental monitoring program plan for upcoming SFY to KDHE due.

Exchange TLDs within seven working days of the start of the new quarter

4.2.3 April

April 1st, KDHE's proposed environmental radiation surveillance program plan and fee statement for upcoming SFY to WCNOC due.

Exchange TLDs within seven working days of the start of the new quarter

4.2.4 May

May 1st, WCNOC comments on KDHE's proposed environmental radiation surveillance program plan and fee statement for upcoming SFY due.

4.2.5 June

June 1st, KDHE's final environmental radiation surveillance program plan and fee statement for upcoming SFY to WCNOC due.

4.2.6 July

July 1st, WCNOC environmental radiation surveillance program plan fee for upcoming SFY due to KDHE.

Exchange TLDs within seven working days of the start of the new quarter.

4.2.7 October

Exchange TLDs within seven working days of the start of the new quarter.

4.2.8 November

November 1st, KDHE Environmental Radiation Surveillance Report with fiscal statement for previous SFY due to WCNOC.

4.3 Sampling and Maintenance Frequencies

4.3.1 Weekly

Air sample collection.

TLD reader reference light check.

4.3.2 Monthly

Surface water and drinking water sample collection.

.4.3.3 Quarterly

Milk sample collection.

TLD exchange and processing (environmental and personal).

4.3.4 Semiannually

Fish sample collection..

Air sampler maintenance, calibration, and change out.

4.3.5 Annually

Garden vegetation, sediment, soil and pasturage trending samples.

Trending samples for aquatic vegetation.

Ground Water and New Strawn City Lake surface water.

TLD energy calibration.

Game animal sample collection (Discontinued but collected if available).

Air sampler calibration.

4.3.6 *Deleted*

4.4 Sample Descriptions

4.4.1 Air

Five air sampling sites, four of which are collocated with WCNOC, have continuously operating low-volume air samplers contained in a fiberglass housing mounted to utility poles approximately one meter from the ground. Air samplers are located at Sharpe, East of the Coffey County Lake dam, Burlington, New Strawn, and Harris. The collocated sites include the highest calculated annual average ground level relative concentration (χ/Q) area at Sharpe, the highest calculated annual average ground level relative deposition (D/Q) area at New Strawn, and a control location at Harris. An average flow rate of about 30 liters per minute is used with 47 mm diameter glass fiber particulate filters and 5 percent TEDA (Tri-ethylene di-Amine) impregnated carbon cartridges for radioiodine activity (the major isotope of concern is ^{131}I). TEDA acts as a chelating agent to bind the iodine chemically and reduce loss by desorption.

Air samples are collected weekly. Field assay of each particulate filter and the charcoal cartridge is done at the time of collection. The particulate filter is counted using a thin window GM 'pancake' style detector (Ludlum Model 22-40 or equivalent) and a count rate instrument. A net count rate of greater than two times the net count rate of the current control (Harris D-1) air sample indicates a potential anomaly and the filter is flagged for individual gamma isotopic analysis. The charcoal

cartridge is counted with a 1"x1" Sodium Iodide (NaI) scintillation detector (Ludlum Model 44-2 or equivalent) and a count rate meter capable of single channel analysis set up for ^{131}I using a ^{133}Ba standard. A net count rate of 100 cpm or greater indicates a potential anomaly and the cartridge and its associated filter is flagged for individual gamma isotopic analysis.

Gamma isotopic analysis is done on two composite samples, one composed of the five particulate filters and the other of the five charcoal cartridges. Indication of ^{131}I or any other fission or activation product requires that a gamma isotopic analysis be done on each individual particulate filter and associated charcoal cartridge.

4.4.2 Direct radiation monitoring

Direct radiation monitoring is accomplished by the Radiation and Asbestos Control Program's thermoluminescent dosimetry (TLD) system, which consists of a Victoreen 2800M reader using Victoreen Model 2600-49 axial bulb manganese-doped calcium fluoride (CaF_2:Mn) dosimeters. Dosimeters are individually calibrated to ^{137}Cs (cesium) and each reading is corrected for fading, self irradiation, and any dose received while in transit.

Thirty-one locations around the WCGS are monitored by KDHE, including three control locations greater than ten miles from WCGS. Three bulb dosimeters are used per site to generate an average quarterly reading per site. The dosimeters are contained in specially constructed PVC plastic holders suspended approximately one meter above the ground. Staff exchange TLDs quarterly. KDHE has collocated TLDS with WCNOC at fourteen sites. WCNOC uses Panasonic Model UD-814-AQ TLDs. Each dosimeter consists of one lithium borate element and three calcium sulfate elements in a plastic case.

4.4.3 Surface water

Surface water sampling is done by the collection of one gallon (3.8 ℓ) grab samples at the indicated locations. Three locations are collected monthly. One control sample is collected monthly below the John Redmond Reservoir (JRR) dam near the makeup screen house. Two samples are collected from the Coffey County Lake, one at the discharge cove and the other at the spillway. The spillway sample is only required if there has been water flow over the spillway in the last month. A sample is also collected annually from the New Strawn City Lake.

A gamma isotopic and tritium (^3H) analysis is done on each water sample. Gross Alpha + Beta analysis is done on each CCL discharge cove sample. Samples split with WCNOC include the control sample at JRR and the two Coffey County Lake samples.

4.4.4 Ground water

Ground water is collected annually at wells in sectors B (control), J, L, and N. The control sample location is hydrologically up gradient from the facility and the other three are hydrologically down gradient.

Gross alpha+beta, tritium and gamma isotopic analysis are done on each sample. Samples are split with WCNOC.

4.4.5 Drinking water

4.4.5.1 Two public water supplies are sampled for drinking water. These water supplies use the Neosho River as a drinking water source.

Burlington is sampled as a control location, being upstream from the WCGS, and LeRoy, the first public water supply downstream of the WCGS, is also sampled. LeRoy is collocated with WCNOC. WCNOC samples Burlington and delivers sample results to the ERS Program RCI.

Le Roy samples are collected monthly by WCNOC personnel using their installed water sampling system collecting 10 mℓ every hour over a 30 day period. WCNOC and KDHE split the sample collected by the WCNOC sampler. The KDHE sampler will be used as a spare.

Samples are analyzed for tritium, and gamma isotopes. Quarterly composites of consecutive monthly samples are analyzed for strontium (^{89}Sr and ^{90}Sr).

4.4.5.2 *Deleted*

4.4.6 Milk

A milk sample is collected quarterly in Coffey County at a dairy near Lebo. This sample is a control and no indicator locations are available within the 10-mile Emergency Planning Zone of WCGS.

The milk sample is analyzed for low levels of radioiodine (major isotope of concern is ^{131}I) and other gamma emitting nuclides. A strontium analysis is done annually.

4.4.7 Sediment and soil

4.4.7.1 Shoreline sediment, bottom sediment.

Sediment samples for trending are collected annually in the Coffey County Lake discharge cove, public environmental education area (shoreline only), and public fishing area (shoreline only). Sediment samples for trending are also collected on Wolf Creek below the Coffey County Lake dam, and at John Redmond Reservoir. There is an additional bottom sediment trending sample collected in CCL just north of the main outfall. The sediment samples obtained at John Redmond Reservoir are used as controls. The Coffey County Lake and John Redmond Reservoir trending sediment samples are split with WCNOC.

Random sediment samples are collected at least annually as detailed in the current SFY ERS Program (See Environmental Radiation Surveillance Procedure RCP/ERS-6 for details.)

4.4.7.2 Soil samples.

Soil samples for trending are collected annually close to Sharpe, east of WCGS at the Scott Valley Church (control), east of the Coffey County Lake dam, and at the Coffey County Lake public fishing and environmental education areas. Trending soil samples collected from the Coffey County public use areas are split with WCNOC.

Random soil samples are collected at least annually as detailed in the current SFY ERS Program (See Environmental Radiation Surveillance Procedure RCP/ERS-3 for details.) All random soil samples from WCNOC property are split with WCNOC.

A gamma isotopic analysis is done on all sediment and soil samples collected. A strontium analysis is done on any sediment sample collected in the Coffey County Lake discharge cove and may be done on other sediment or soil samples based upon the gamma isotopic analysis results.

4.4.8 Fish, game animals, and domestic meat

Fish are collected semiannually from the Coffey County Lake and below John Redmond Reservoir on the Neosho River. Sample portions from fish collected in the Coffey County Lake and below John Redmond Reservoir on the Neosho River are split with WCNOC. Fish collected at John Redmond Reservoir on the Neosho River are used for control samples.

Domestic meat samples are no longer required due to the unavailability of animal husbandry data. As a result pasturage and animal feed sampling has been increased by random sample collection as described in (4.4.9.1) below.

A gamma isotopic analysis will be done on all samples collected. Sample portions are usually edible, however, inedible portions may also be analyzed. Tritium in tissue analysis (fat and water) is done on the edible portions of at least one species of fish from each location sampled.

4.4.9 Terrestrial and aquatic vegetation

4.4.9.1 Terrestrial vegetation

Samples are taken at various locations around the WCGS. This includes samples of crops grown throughout Coffey County, broad leaf vegetation taken from gardens near the WCGS boundary, pasturage near WCGS, and crops irrigated with water from the Neosho River. Pasturage samples are usually collected concurrently with soil samples.

There are five annual pasturage and two annual garden trending locations. Random vegetation samples are collected at least annually as detailed in the current SFY ERS Program (See Environmental Radiation Surveillance Procedure RCP/ERS-10 for details.) Samples split with WCNOC include pasturage samples collected at the Coffey County Lake public use areas, garden vegetables collected from gardens near WCGS, and samples of crops irrigated with water from the

Neosho River.

A gamma isotopic analysis is done on each vegetation sample and edible portions of food products collected. A strontium analysis is done on selected samples based upon gamma isotopic analysis results.

4.4.9.2 Aquatic vegetation (algae or rooted aquatics).

Trending samples are collected annually from the Coffey County Lake, Wolf Creek below the Coffey County Lake dam, and John Redmond Reservoir. The aquatic vegetation samples obtained at John Redmond Reservoir are used as controls. The Coffey County Lake samples are split with WCNOC.

Random aquatic vegetation samples are collected at least annually as detailed in the current SFY ERS Program (See Environmental Radiation Surveillance Procedure RCP/ERS-7 for details.)

It should be noted that the availability of aquatic vegetation samples is widely variable. In extremely dry or wet years samples may not be available at all. In such cases every effort will be made to collect trending samples first and then random samples. Shortfalls of samples will be documented in the annual report.

Gamma isotopic analysis is done on all aquatic vegetation samples collected. Strontium analysis is done on any aquatic vegetation sample collected in the Coffey County Lake discharge cove and may be done on other aquatic vegetation samples based upon the gamma isotopic analysis results.

Section 5

DESCRIPTION OF SAMPLING EQUIPMENT

5.1 Description of Sampling Equipment

Descriptions of the sampling equipment and associated decontamination procedures are provided in the ERS SOPs.

5.2 Equipment used by the DHEL Radiochemistry laboratory

5.2.1 Multichannel gamma-spectrometer

Gamma radiation is measured and classified by using a Canberra Genie-2000 MCA System. Detectors available are a Harshaw 3-inch x 3-inch NaI(Tl) crystal, a 105cc (20 percent efficiency) GeLi crystal, a 40 percent efficient HPGe crystal, and a 15 percent efficient HPGe crystal.

5.2.2 Low background alpha/beta system

An Oxford Series 5XLB and a Tennelec 5100 alpha/beta low background IPC system is used for strontium (^{89}Sr and ^{90}Sr), radium (^{228}Ra), and gross beta counting.

5.2.3 Internal proportional counter (IPC)

Gross alpha, uranium, and radium analyses are made with four Nuclear Measurement Corporation (NMC) windowless gas flow IPC systems.

5.2.4 Liquid scintillation

Tritium, nickel (^{63}Ni), and radon (^{222}Rn) in water analyses are performed using a Beckman LS-230 and a Wallac-1409 liquid scintillation system.

5.2.5 Miscellaneous equipment

The Radiochemistry Section has several pieces of equipment used for special projects. A Ludlum Model 2200 single channel analyzer is used with a radon flask scintillation counter for radon and radium analyses. Another Ludlum Model 2200 single channel analyzer is used with a halogen quenched GM pancake probe for routine monitoring of personnel and incoming samples.

Section 6

DESCRIPTION OF FIELD PROCEDURES

6.1 Description of Field Procedures

A description of field procedures, including sample collection, analysis, preservation, transport and chain-of-custody procedures and accompanying safety protocols are in the ERS SOP.

Section 7

LABORATORY PARAMETERS AND PROTOCOLS

7.1 Laboratory Parameters and Protocols

The laboratory parameters are indicated in Attachment 1 under the column Analyses Required. The laboratory protocols are contained in the Division of Health and Environment Laboratory (DHEL) standard operating procedures.

Section 8

DATA VALIDATION AND MANAGEMENT

This section provides a description of data validation, storage, transfer, reporting and backup requirements and any special documentation requirements.

8.1 Reduction and Validation of Data

As sample results are received from the DHEL Radiation Chemistry Section, they are reviewed to insure that the data has been properly and accurately reported and that results are within the range expected. If not, the Radiation Chemistry Laboratory is contacted to verify the data. Validated data is entered into a PC Spreadsheet for later reduction, evaluation and use.

8.2 Reporting of Data

For each radiological sample analysis performed, the DHEL Radiation Chemistry Section provides a written sample analysis report directly to the Environmental Radiation and Emergency Preparedness Unit (EREP) staff via inter-office mail.

The results of KDHE's radiological environmental monitoring programs are reported annually (November) in a published document, *Wolf Creek Generating Station Environmental Radiation Surveillance Report*. Copies of this report are sent to the KDHE Secretary, Wolf Creek, Coffey County, DHEL Radiation Labs, and two copies are retained by the Kansas Legislative library.

8.3 Data Retention and Backup

All data obtained as part of this plan are retained in hard copy by the EREP section for three years. After that time only the annual report is required to be archived since DHEL retains their original copies of all analytical data in hard copy and electronically. The annual reports are retained, at least, for the lifetime of WCGS. Archiving of the reports and any data that needs to be retained is done in accordance with current administrative procedures for record retention.

Data backup of reports, worksheets, tables, logs and program correspondence is currently kept on CD-ROM.

8.4 Additional Data Management Activities

Detailed data management procedures are in the ERS SOP.

Section 9

EQUIPMENT CALIBRATION AND AUDITING

This section describes equipment testing, auditing, calibration, and preventive maintenance procedures.

9.1 Calibration

Calibration documentation shall be maintained for each instrument requiring such in a central file. Documentation shall include calibration data (and/or curve), instrument identification, date of calibration, name of person who performed the calibration, calibration standards used (and their traceability), and pertinent calibration equipment used in the calibration.

Each instrument shall be operated as described in its operational manual (provided by the manufacturer) and in accordance with specific guidance provided in this plan and the appended SOP's. Radiation measurement instruments are also response checked prior to each use with appropriate check sources. The expected instrument response is listed on each source. Variance from the expected response by >20% constitutes failure and the instrument is placed out of service pending further evaluation.

All radiation measurement instruments are calibrated at least annually by Ludlum Measurements Inc. of Sweetwater, Texas. Air Sampler Maintenance and Calibration is described in RCP/ERS-13. The TLD Reader Operation, Maintenance, and Calibration procedure is RCP/ERS-14. Calibration of a piece of equipment establishes the relationship between actual concentration in the sample and the instrument's response. This relationship shall be used for the conversion of subsequent instrument response values to corresponding analytical results until superseded by a later calibration of the instrument.

9.2 Preventive and Remedial Maintenance

All instrumentation shall be maintained in accordance with specific manufacturers' recommendations or established procedures as stated above. Maintenance documentation shall be maintained in a central file. As a minimum, maintenance documentation must include instrument identification, date of maintenance, name of person who performed maintenance, and type of maintenance performed.

9.3 Additional details on calibration and maintenance

Additional procedures required for calibration and maintenance are in the ERS SOP.

Section 10

PURCHASED EQUIPMENT

10.1 Purchased Equipment

This section provides a description of inspection procedures and acceptance requirements for purchased equipment and supplies.

The following checks are made when new equipment has been received: Check to make sure all the parts in the packing list are actually there. Check for broken parts. Check that all parts fit together during assembly. If there is a motor, check to see that it turns on when power is supplied.

Section 11

EVALUATION PROCEDURES

This section contains a description of procedures (including statistical procedures) used to evaluate data precision, accuracy, completeness, representativeness and comparability, including a detailed characterization of internal QC procedures and external performance audit requirements.

11.1 Calculation Procedures

For precision calculations on collocated data (monitors located at the same site) or precision calculations on split samples, the agreement ratio is found by the following formula:

$$R = \frac{Y}{X}$$

Where R is the ratio, Y is the KDHE concentration, and X is the WCNOC concentration.

Percent completeness (PC) (criteria are described in section 3 above) is found by using the following formula:

$$PC = \frac{NV}{NT} \times 100$$

Where NV is the number of valid samples and NT is the number of theoretical (scheduled) samples.

Some parameters may be normalized against control values (either measured or calculated). This will be done by either subtracting the control value or dividing by the control. This is done in order to smooth some data for graphing or to facilitate more accurate agreement ratios.

See Section 3 above to see how these calculations are applied.

11.2 Further Data Evaluation

All data is evaluated by sample type and location. Various parameters are analyzed for standard deviation (STD), average (avg) and the coefficient of variance (CV).

$$CV = \left(100\% * \left(STD / avg\right)\right)$$

Further evaluation may be done as needed within the annual report in the form of graphs, tables and charts.

11.3 Quality Control and Auditing

All personnel are required to follow the stated ERS SOP. Any deviation from stated procedures will be documented. Inability to perform any procedure as written will be documented and investigated. Minor procedural changes may be made to the SOP if required, such changes will be reviewed and approved by the EREP RCI and the EREP PHP. Such changes will not require a full revision of this plan or the SOP as long as the change will not effect the outcome of the procedure.

The program will undergo an annual internal review. This review will be used to identify any improvements, deficiencies or changes that need to be addressed prior to the initial plan submission to WCNOC in April. The review will be done by the EREP ET III and audited by the EREP RCI. The review and audit will be complete by February 1st.

Section 12

SPECIAL TREATMENT OF DATA

12.1 Special Treatment of Data

This section describes procedures used to evaluate and enhance utility of environmental monitoring data including, but not necessarily limited to, procedures and assumptions applied in the identification and treatment of (a) outliers and other anomalous data, (b) nonlinear data requiring statistical transformation, and (c) values reported as "less than" or "greater than" established reporting limits**.**

Radioactive decay of unstable atomic nuclei is a totally random event. The larger the number of total counts obtained and the longer each sample is counted, the closer the measurements will be to their actual value. Due to the large number of samples to be analyzed and the limited time available for counting individual samples, each sample is counted only once and for the minimum time necessary to reduce the statistical error to an acceptable level. Unless otherwise specified, results for all samples are reported at the 95 percent confidence level. Because estimates of systematic (non-random) uncertainties involved in sample collection and sample preparation are highly subjective and generally difficult or impossible to achieve with any substantial accuracy, the DHEL Radiochemistry Laboratory reports only the uncertainty resulting from random processes (propagation of statistical counting error).

A "less than" value reported shows that the radioactivity in the sample is below the lower limit of detection for the procedures, equipment, and counting time used.. MDL's depend on the sample matrix, sample size, counting time, detector efficiencies, and type of measurement required. The DHEL Radiochemistry Laboratory MDL's for various analyses will maintain the 95% confidence level and will be summarized in each year's report.

Some data may require normalization against control data. In such cases the control data will be from measured or calculated sources. When such normalization is performed and used in data reporting or presentation the method and control data source will be stated and explained in the report.

Section 13

CORRECTIVE ACTIONS

13.1 Invalidation of Data

Samples collected by the Environmental Radiation Surveillance Program are forwarded to DHEL for analysis. Resultant monitoring data will be voided if it cannot be validated or there is good reason to suspect that the data are inaccurate. Data shall be invalidated by a supervisor based upon calibration checks, audits or failure to adhere to the provisions of the QA Plan or SOPs.

13.2 Equipment Malfunction

Any deficiency in equipment performance discovered in the course of routine operation should be noted in writing. Within the manufacturer's guidelines, the defective equipment may be serviced by EREP personnel or returned to the manufacturer for repair or replacement. If available, back-up equipment shall be utilized during the interim to minimize interruption of operations.

13.3 Staff Performance Problems

In the event that a staff member exhibits difficulty with a given procedure, additional training shall be provided. Modification of procedure(s) to facilitate execution may be beneficial.

Section 14

QUALITY OF ACQUIRED DATA

14.1 Quality of Acquired Data

This section describes procedures for determining the quality of ancillary data acquired from external sources not subject to the provisions of the KDHE Division of Environment Quality Management Plan (e.g., meteorological, hydrological, geological, chemical and/or biological data obtained from other state and federal agencies).

The Radiation and Asbestos Control Program acquires meteorological data (MD) from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC). The data acquired are the unedited local climatological data**.**

The MD are used to correlate radiation concentrations to emission data. The NCDC estimate that the MD have an error rate of less than one percent.

CCL water levels are also acquired from WCNOC personnel via their Resource Management Group. These data are used to establish possible correlation of lake and stream level to radioactivity levels monitored. The accuracy of the WCNOC data is ± 20 %. Any other stream or lake level data acquired will have appropriate source and accuracy data appended.

Section 15

REPORTS

15.1 Reports

This section contains a description of program/project deliverables (electronic databases, summary statistics, illustrative materials, interim and final reports, etc.) and schedule for completion.

An end-of-year QA program evaluation shall be conducted by the section chief, and a written report submitted to the bureau director and bureau QA representative by February 15 of the following year. The program evaluation report must indicate when, how, and by whom the evaluation was conducted, the specific aspects of the program subjected to review, a summary of significant findings, and technical recommendations for necessary corrective actions. The Section Chief shall discuss the reported findings with the appropriate program managers and all participating field, laboratory, and data management staff.

For each State Fiscal Year, the Radiation and Asbestos Control Program publishes the *Wolf Creek Generating Station Environmental Radiation Surveillance Report*. This report covers the results of sampling in the environment surrounding Wolf Creek Generating Station by the KDHE according to K.A.R. 28-19-81.

Section 16

TRAINING

16.1 Training

New employees (including recent transfers from other programs) receive a thorough indoctrination into the QA/QC policies and procedures of the Environmental Radiation Surveillance Program. Part I of the Division of Environment Quality Management Plan (QMP), the Bureau of Air and Radiation QA program plan, and this document and its associated SOPs, are required reading on the part of all new employees. All employees participating in environmental monitoring activities shall review these documents annually in accordance with Part I of the QMP. All new employees shall participate in the orientation seminars offered by the KDHE Personnel Office. New supervisors are also expected to complete the introductory course for supervisors offered by the Department of Administration.

All personnel involved in any function related to data quality must have sufficient training in their appointed jobs to contribute to the reporting of data of high quality. Such personnel include sample collectors, equipment/instrument operators, auditors, data processors, and QA oversight staff.

The Bureau of Air and Radiation maintains a library of educational materials and a satellite television receiver system which may be utilized for training and/or continuing educational purposes. Workshops, symposia, or continuing educational courses offered by colleges, vocational educational institutions, or various governmental agencies may be attended by appropriate staff. In order for an employee to participate, the subject matter must be applicable to a program or project, funding must be available, and supervisory and administrative approval must be secured in advance.